National Academies of Science:

Co-located Electricity Generation, Data Centers, and Opportunities for Flexibility

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Abe Silverman

abe.silverman@jh.edu * 301-949-5406

Historical Context

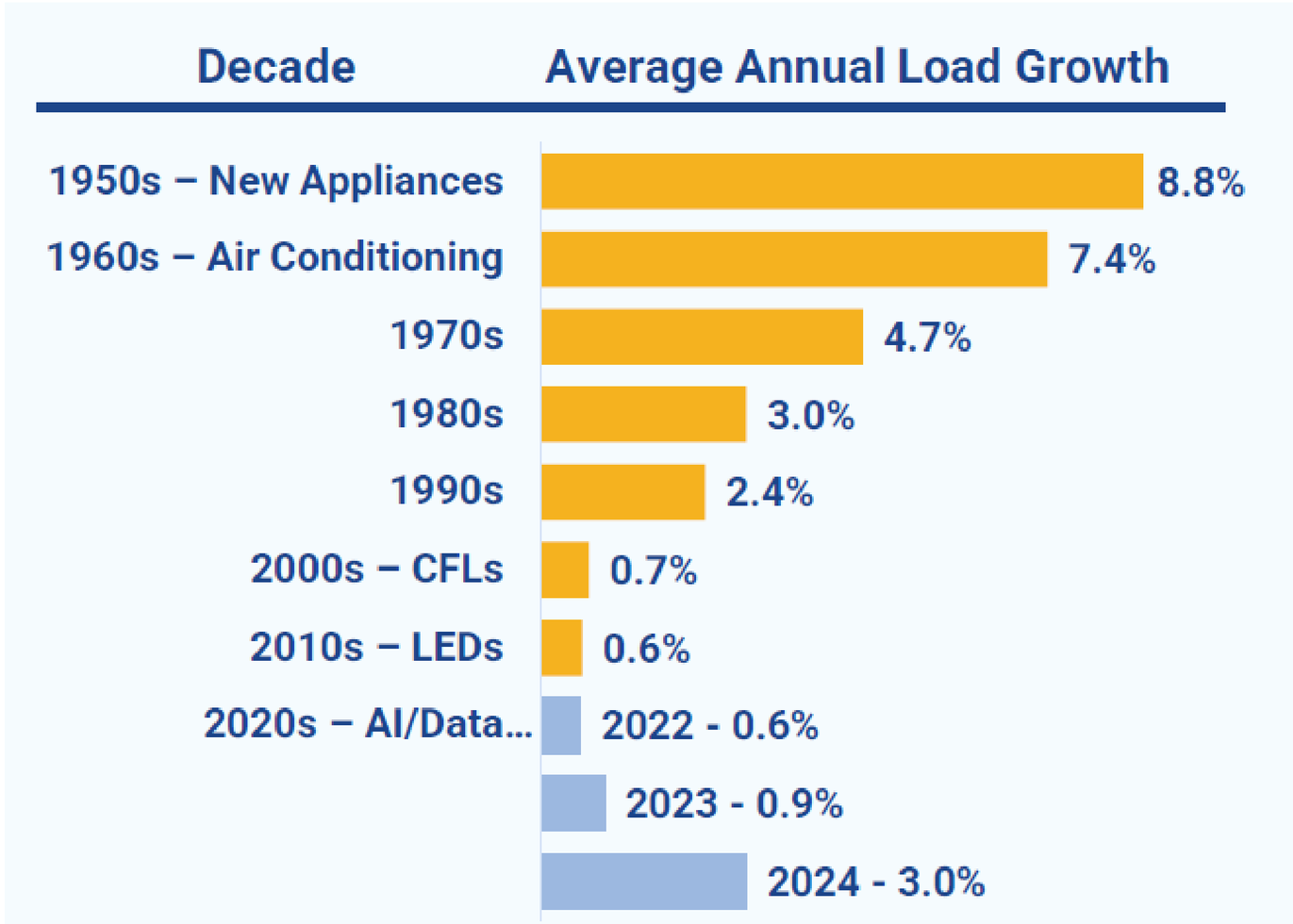
> Driven by electrification, hydrogen production, data centers, crypto mining, and other computational and energy-intensive methods such as artificial intelligence (AI), **new loads can emerge and grow faster than generation and transmission can be built.**

NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

ERO Reliability Risk Priorities Report

NERC, August 2023

(Emphasis added)



SOURCES | NERC, 2022 Long-Term Reliability Assessment (December 2022), p. 20 and Supplemental Table F.
Edison Electric Institute, *EEI Industry Capital Expenditures with Functional Detail*, published October 2021, September 2022, September 2023 and September 2024.
Grid Strategies, Fewer New Miles: The US Transmission Grid in the 2020s (July 2024).

Grid Strategies, Strategic Industries Surging: Driving US Power Demand

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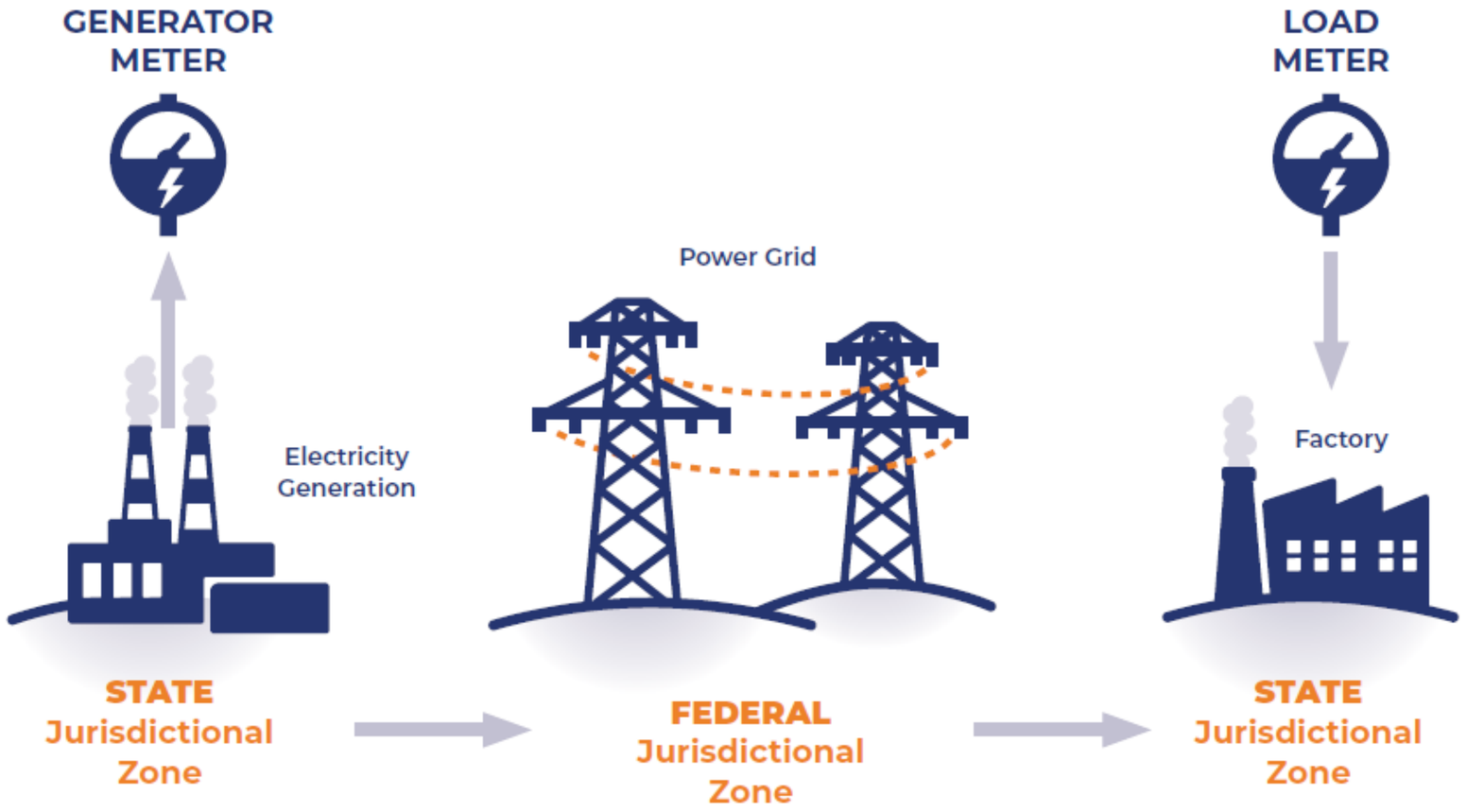
Jurisdiction:

"The issues presented in [the co-location] proceeding implicate both federal and state interests, and their resolution will require the involvement of both federal and state actors, including the Commission, state public utility commissions, and other state and local entities."

FERC Docket No. EL25-49-000 at P 66

What Pieces of the Data Center Ecosystem do States Have Authority Over?



From Kleinman Center for Energy Policy, UPenn (https://kleinmanenergy.upenn.edu/research/publications/wholesale-electricity-justice/)

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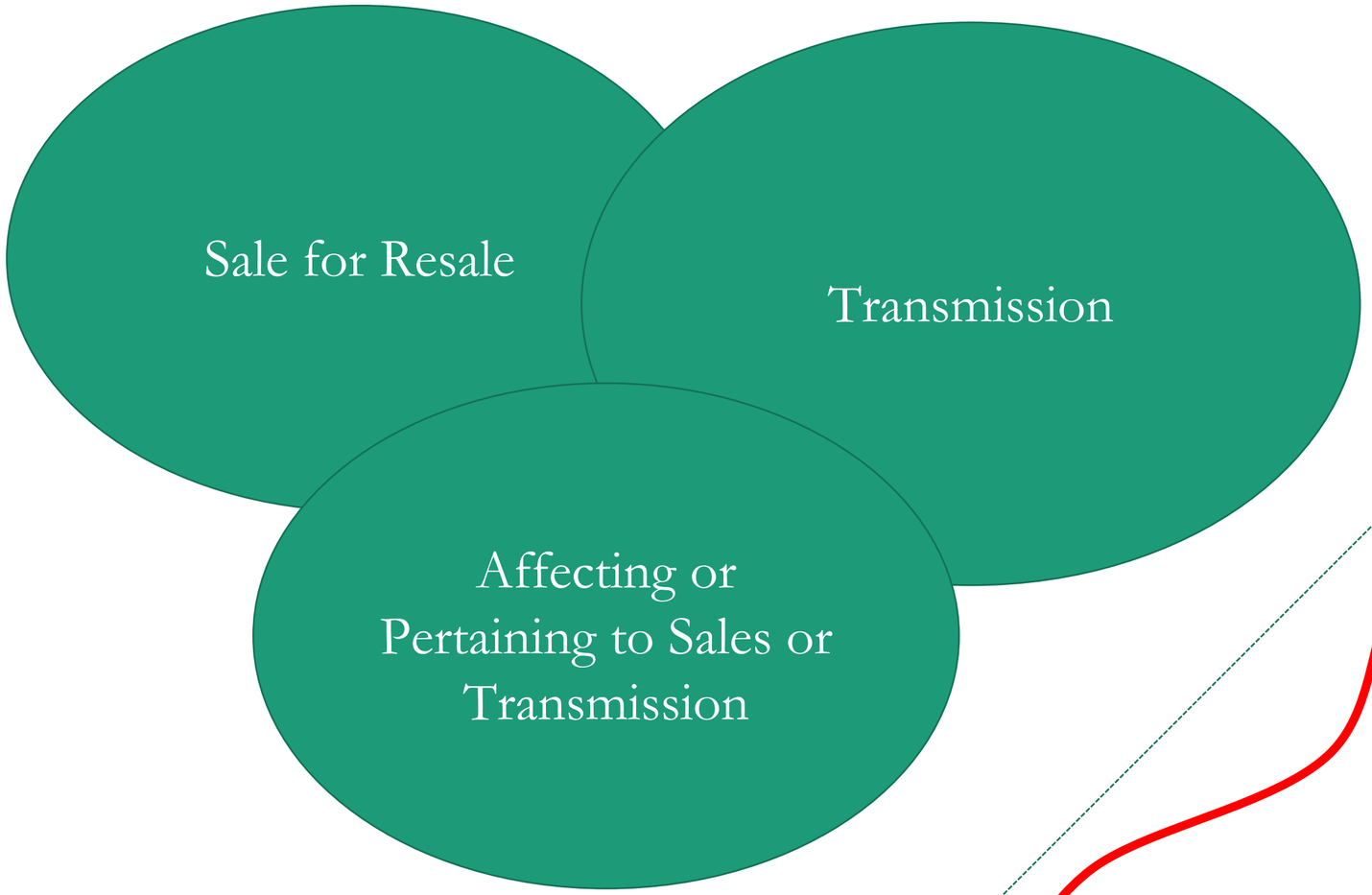
The Federal Power Act for Visual Learners

Sum of FERC's Jurisdiction:



State Jurisdiction:

"…any other sale of electric energy…"

(i.e., retail)

COLOCATION DISCUSSION

PJM has 8,000 MW of co-location requests pending

FERC initiated a Show Cause order in Docket No. EL25-49-000 to address concerns raised in multiple dockets.

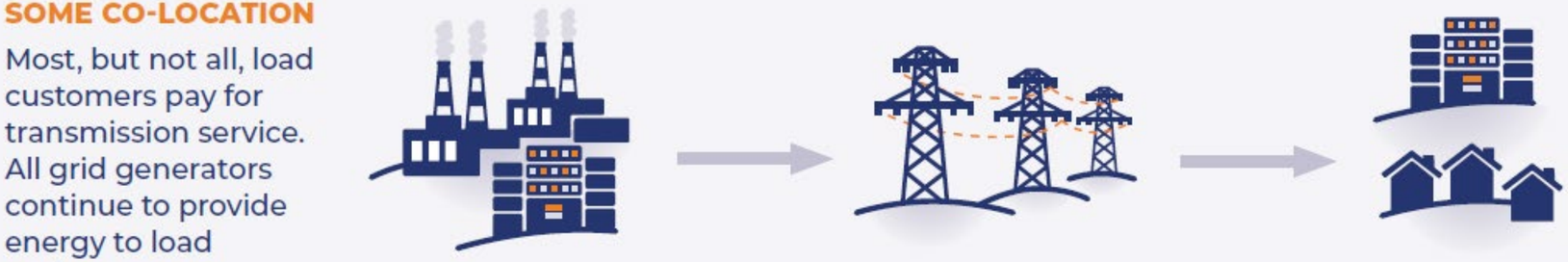
Colocation is prompting broader industry debate on interconnecting large loads.

NO CO-LOCATION

All load customers pay for transmission service. All generators provide energy to load customers.

SOME CO-LOCATION

Most, but not all, load customers pay for transmission service. All grid generators continue to provide energy to load customers.



WIDESPREAD CO-LOCATION

Fewer load customers pay for transmission service, but the cost to operate the grid remains. All grid generators provide energy to load customers.

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Risk #1:

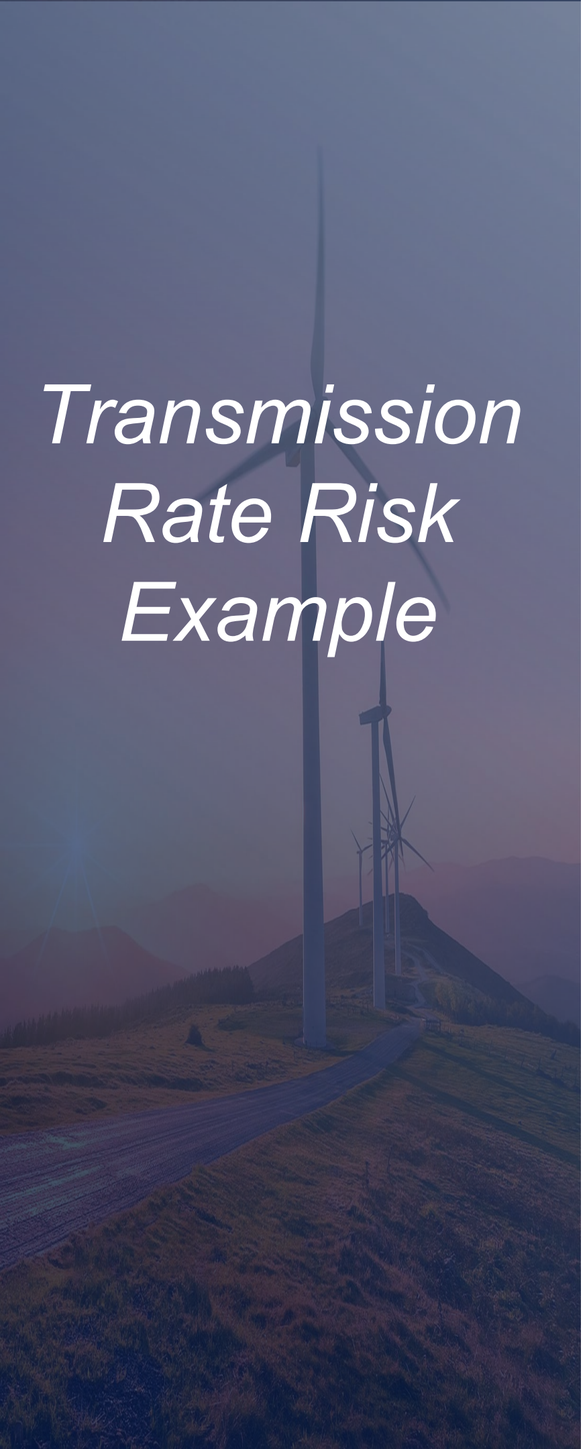
Transmission Rate Risk

Stranded Cost and Cost Increases

1) Duplicative data center requests lead to over-investment in transmission;

2) Data centers leave the system or use less energy than expected, leaving consumers to pick up the slack; and

3) Rate shock as new transmission expenses come in faster than new revenues.



Transmission Rate Risk Example

Hypothetical Risks to Retail Consumers:

- A data center, Hyperscale 1, requests 1 gigawatt of new service, starting in 2028.
- Utility A agrees to build $1 billion in upgrades to the high-voltage transmission system.
- The costs of the new transmission facilities are allocated 50% to Utility A's customers and 50% to the customers of neighboring utilities.

Analysis:

- Hyperscale 1 expects to pay $100 million in transmission service per year, effectively paying off the new upgrades in 10 years.
- Hyperscale 1 suffers a severe economic* set back in 2030, leading to their taking only 10% of their expected service (i.e., paying $10 million per year in transmission service instead of $100 million).
- Utility A's consumers and consumers in the neighboring grid are now left paying $90 million in "stranded" transmission costs.

* Note: Increased energy efficiency or technological advancement that reduces the data center's electricity usage would have the same net negative impact on other consumers.

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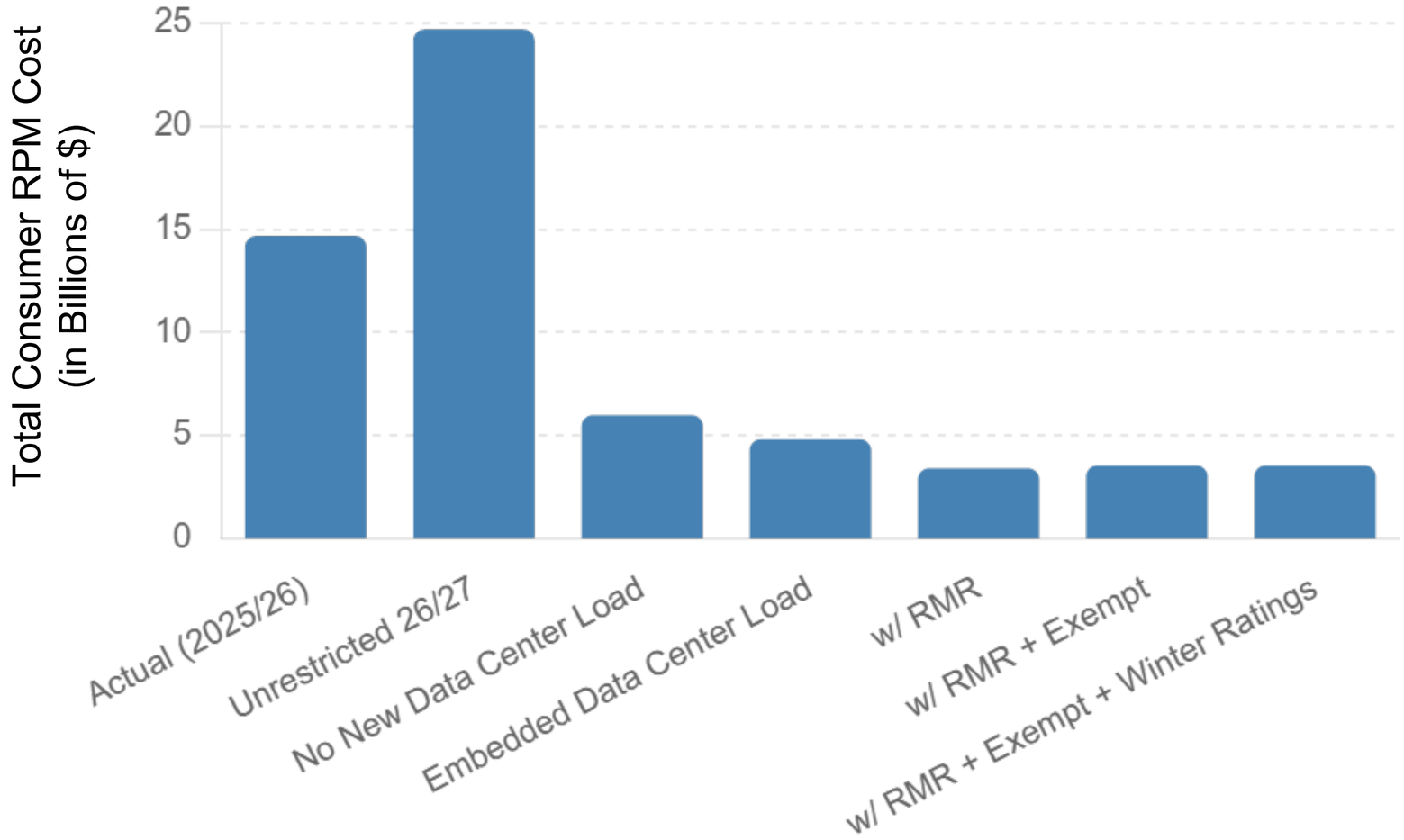
Load Growth in PJM

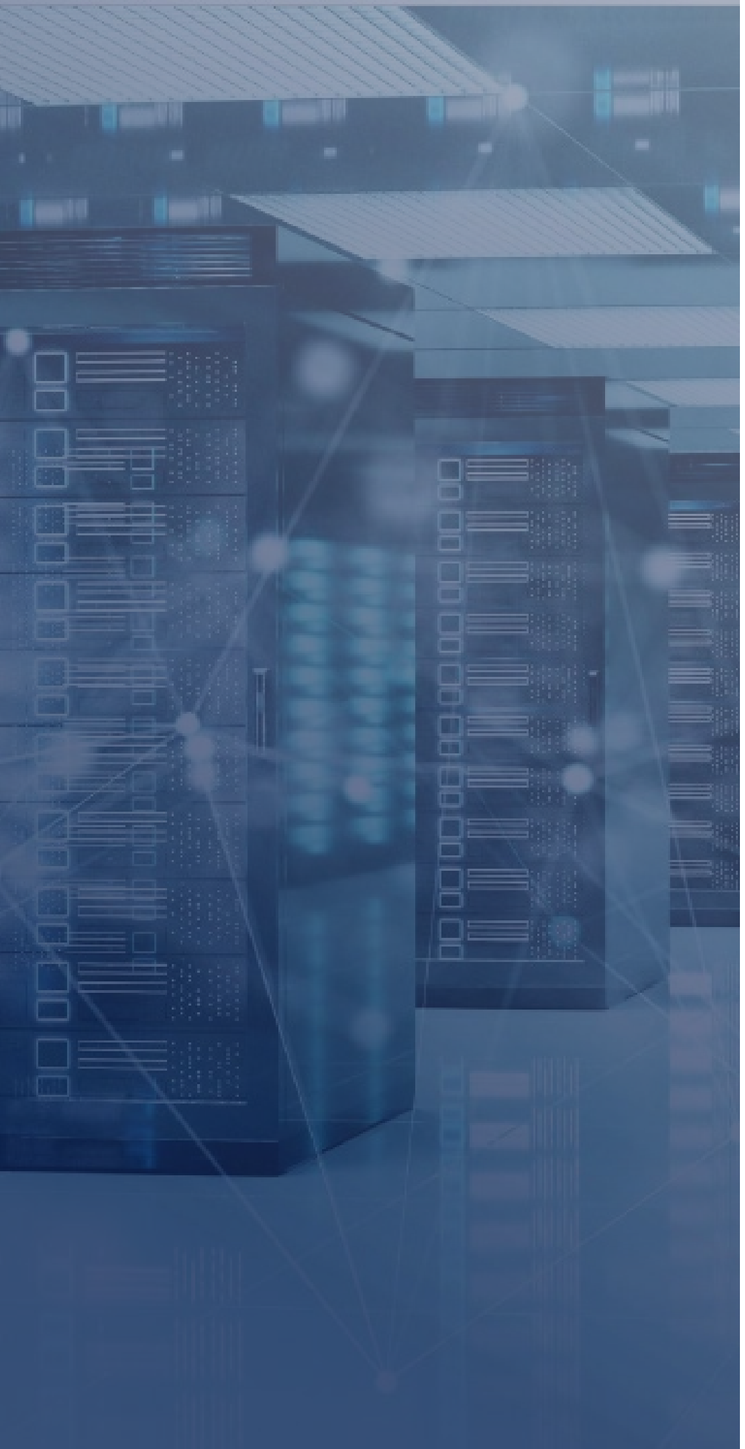
“If … the 2025/2026 RPM BRA had been cleared with the 2026 peak load forecast that did not include 7,892 MW of forecast load growth from planned data centers and from existing data centers … total RPM market revenues … would have been [approximately. $6 billion], a decrease of … 75.8 percent

Monitoring Analytics

Dr. Joe Bowring, IMM for PJM

Role of Data Centers in Recent Capacity Cost Increases





Five Questions for States on Large Data Center Load Growth

1. What steps can States take to reduce increases in **transmission rates** driven by data center development?

2. How can States help ensure that **supplies of energy** remain adequate and affordable in the face of data center expansion?

3. How do we manage the risk that we **over-invest** in energy infrastructure if data center load does not materialize as projected?

4. How do States with **clean energy policies** ensure data center expansion is handled in a manner consistent with those policies?

5. How do we weigh the **economic development opportunities** against potential cost increases?

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LEVER #1

Improve Administrative Information Collection & Improve Processing of Data Center Requests for New Service

Address Double Counting of Requests	Implement rules, similar to Texas Senate Bill No. 6, which would require data centers to disclose multiple service requests to avoid duplication in utility load forecasts.
Refine Load Forecasting	Refine load forecasting to consider the potential of load growth, recognizing high- and low-probability data center expansions and incorporating requirements such as requiring site control, customer commitments, and up-front deposits to support load forecasts.
Enhance Data Collection	Require data centers to provide comprehensive information in their load application, such as energy usage patterns, load ramp projection, and capability/willingness to curtail usage when the power grid is experiencing stress.
Reform Utility Queuing Processes for Large Load Connections	Create publicly accessible load connection queues and standardized study processes, enhancing transparency and regulatory oversight.

LEVER #2

Clarify the Right of Utility Regulators to Allow PSCs to Tailor Rates to Data Centers

Clarify PSC's role in Establishing Utility Rates for Data Centers	Clarify that Public Service Commissions (PSCs) can establish specific tariffs for data centers, recognizing their unique operational characteristics and impacts to the power grid and other system users.

LEVER #3

Establish Substantive Requirements for New Data Center Requests

 **Establish financial commitments for New Data Center Requests**	Require financial commitments from data centers to protect against stranded transmission investments, ensuring financial accountability. Commitments might include; minimum contract term, security deposits, minimum billing, notice requirements, exit fees, and other terms tailored the state regulatory needs.
 **Require Contribution to Grid Modernization Funds**	Require data centers contribute to a grid modernization fund to provide ratepayer relief for necessary transmission investment. Fund could be structured to support other state energy policies, such as the deployment of Advanced Transmission Technologies or similar grid modernization initiatives.
 **Require Flexibility in Data Center Operations**	Encourage utilities and regional grid operators to develop and implement flexible tariff rates or interruptible rates that will offer incentives for flexible operations. More flexible operations can avoid or delay transmission investments and aid operators during period of grid stress.
 **Require Data Center Developers to Fund Research to Enhance Energy Efficiency**	Require data Centers to fund or contribute to R&D to enhance the operational efficiency of the data centers and reduce future loading on the grid as the industry continues to expand.
 **Set Clean Energy Content Requirements**	Establish and/or strengthen state decarbonization goals by setting clean energy content requirements that apply uniformly across customer classes, including data centers.
 **Impose "Bring Your Own" Energy or Capacity Requirements**	Require data centers to secure additional generation commitments by a set timeline in order for the new load to be connected and supplied.